

CLAIMS

1. An impact-absorbing steering column apparatus comprising collision-energy-absorbing means for absorbing secondary collision energy of an occupant in the event of a collision of a vehicle, the collision-energy-absorbing means comprising energy-absorption-load-changing means for changing an absorption load for the secondary collision energy, and the energy-absorption-load-changing means being adapted to change the absorption load in accordance with displacement of a steering column, the displacement changing dependently on a secondary collision of the occupant with a steering system.
2. An impact-absorbing steering column apparatus comprising collision-energy-absorbing means for absorbing secondary collision energy of an occupant in the event of a collision of a vehicle, the collision-energy-absorbing means comprising energy-absorption-load-changing means for changing an absorption load for the secondary collision energy, and the energy-absorption-load-changing means being adapted to change the absorption load in accordance with displacement of a steering column in a direction intersecting a direction of relative movement of the steering column for absorbing collision energy induced by a secondary collision of the occupant.
3. An impact-absorbing steering column apparatus as described in claim 1 or 2, wherein the energy-absorption-load-changing means changes the absorption load in accordance with a mode of displacement of the steering column.
4. An impact-absorbing steering column apparatus as described in claim 3,

wherein the energy-absorption-load-changing means comprises an energy-absorbing member, and engagement means capable of engaging with the energy-absorbing member, and an engagement relation between the energy-absorbing member and the engagement means varies in accordance with a mode of displacement of the steering column, thereby changing the absorption load.

5. An impact-absorbing steering column apparatus as described in claim 4, wherein the engagement means is squeezing means for squeezing the energy-absorbing member; the energy-absorbing member has an energy-absorbing portion, which is squeezed by the squeezing means to thereby absorb energy; and an engagement relation between the squeezing means and the energy-absorbing portion varies in accordance with a mode of displacement of the steering column, thereby changing the absorption load.

6. An impact-absorbing steering column apparatus as described in claim 4, wherein the engagement means is squeezing means for squeezing the energy-absorbing member; the energy-absorbing member has a plurality of energy-absorbing portions that differ in energy absorption load in relation to the squeezing means; and an engagement relation between the squeezing means and one of the plurality of energy-absorbing portions is selected in accordance with a mode of displacement of the steering column, thereby changing the absorption load.

7. An impact-absorbing steering column apparatus as described in claim 4, wherein the engagement means is squeezing means for squeezing the energy-absorbing member; the squeezing means has a plurality of squeezing portions that differ in the quantity of squeeze in squeezing the

energy-absorbing member; and an engagement relation between the energy-absorbing member and one of the plurality of squeezing portions is selected in accordance with a mode of displacement of the steering column, thereby changing the absorption load.

8. An impact-absorbing steering column apparatus as described in claim 4, wherein the energy-absorbing member is a linear member capable of engaging with the engagement means; the engagement means is engaged with or is not engaged with the linear member in accordance with a mode of displacement of the steering column, thereby changing the absorption load.

9. An impact-absorbing steering column apparatus as described in claim 4, wherein the energy-absorbing member is a plurality of linear members capable of engaging with the engagement means; the number of the linear members to be engaged with the engagement means varies in accordance with a mode of displacement of the steering column, thereby changing the absorption load.

10. An impact-absorbing steering column apparatus as described in claim 4, wherein the steering column comprises the energy-absorbing member, a ball adapted to plastically deform the energy-absorbing member, and ball support means for adjusting the quantity of plastic deformation to be effected by the ball; and the ball support means is moved in accordance with a mode of displacement of the steering column in such a manner as to vary an engagement relation between the energy-absorbing member and the ball in accordance with the mode, thereby changing the absorption load.

11. An impact-absorbing steering column apparatus as described in claim 4, wherein the energy-absorbing member has an elongated groove having a predetermined width; the engagement means is squeezing means assuming

a special shape and capable of being displaced in the elongated groove in relation to the energy-absorbing member; and an engagement relation between the special-shape squeezing means and the elongated groove of the energy-absorbing member varies in accordance with a mode of displacement of the steering column, thereby changing the absorption load.

12. An impact-absorbing steering column apparatus as described in claim 4, wherein an energy-absorbing member is provided on either a vehicle-body-side member or the steering column, the energy-absorbing member generating an energy absorption load by means of displacement in relation to either the vehicle-body-side member or the steering column on which the energy-absorbing member is provided; the engagement means capable of engaging with the energy-absorbing member is provided on either the vehicle-body-side member or the steering column on which the energy-absorbing member is not provided; and when the energy-absorbing member is engaged with the engagement means in accordance with a mode of displacement of the steering column, the mode of displacement changing dependently on a secondary collision, the energy-absorbing member incrementally changes the absorption load by means of displacement in relation to either the vehicle-body-side member or the steering column on which the energy-absorbing member is provided.

13. An impact-absorbing steering column apparatus as described in any one of claims 1 to 12, wherein the energy-absorption-load-changing means changes the absorption load in accordance with displacement of the steering column, the displacement changing dependently on the direction of a secondary collision of the occupant with the steering system.

14. An impact-absorbing steering column apparatus as described in any

one of claims 1 to 13, wherein the energy-absorption-load-changing means changes the absorption load in accordance with displacement of the steering column, the displacement changing dependently on the direction of a secondary collision of the occupant with the steering system at an initial stage of the secondary collision.

15. An impact-absorbing steering column apparatus as described in any one of claims 1 to 14, wherein when a collision load associated with a secondary collision of the occupant with the steering system is equal to or greater than a predetermined value, the energy-absorption-load-changing means increases the absorption load.

16. An impact-absorbing steering column apparatus as described in any one of claims 1 to 15, wherein the energy-absorption-load-changing means increases the absorption load in accordance with such displacement that the steering column tilts upward as a result of a secondary collision of the occupant with the steering system.

17. An impact-absorbing steering column apparatus as described in any one of claims 1 to 16, wherein the energy-absorption-load-changing means changes the absorption load in accordance with a displaced position of the steering column, the displaced position changing dependently on the direction of a secondary collision of the occupant with the steering system.

18. An impact-absorbing steering column apparatus as described in any one of claims 1 to 17, wherein impact-absorbing means for absorbing a predetermined collision load is provided separately from the collision-energy-absorbing means.

19. An impact-absorbing steering column apparatus as described in any one of claims 1 to 18, wherein the collision-energy-absorbing means

selectively produces the absorption load, or changes the magnitude of the absorption load.

20. An impact-absorbing steering column apparatus as described in claim 1 or 2, wherein in accordance with a load of pressing the steering column against a vehicle-body-side member and a load of moving the steering column toward the front of the vehicle, the loads changing dependently on a secondary collision of the occupant with the steering system, deformation of an energy-absorbing member provided on either the steering column or the vehicle-body-side member is passively changed by engagement means provided on either the steering column or the vehicle-body-side member on which the energy-absorbing member is not provided, whereby the energy-absorption-load-changing means changes the absorption load.

21. An impact-absorbing steering column apparatus as described in claim 20, wherein the engagement means is formed on the vehicle-body-side member; the energy-absorbing member is provided on the steering column in opposition to the engagement means and assumes an elongated shape extending along an axis of the steering column; and the engagement means provided on the vehicle-body-side member causes the deformation of the energy-absorbing member provided on the steering column.

22. An impact-absorbing steering column apparatus as described in claim 20 or 21, wherein only when a collision load imposed on the vehicle-body-side member from the steering column is equal to or greater than a predetermined value, abutment between the engagement means and the energy-absorbing member is enabled.

23. An impact-absorbing steering column apparatus as described in any one of claims 1 to 22, wherein in the event of a secondary collision, the

steering column is allowed to be displaced in such a manner as to tilt toward a vehicle-body-side member.

24. An impact-absorbing steering column apparatus as described in any one of claims 1 to 23, wherein the absorption load is increased with a load of pressing the steering column against a vehicle-body-side member.

25. An impact-absorbing steering column apparatus as described in any one of claims 1 to 24, wherein impact-absorbing means for absorbing a predetermined collision load is provided separately from the collision-energy-absorbing means.